Stoller
Hanford Office

DOE-EM/GJ656-2004

C4552
Log Data Report
Revised

Borehole Information:

Borehole: C4552			**Site:** 216-U-8 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:** 05/13/2004	
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not Available	Not Available	May 2004	Not Available	60	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0.4	7	6	1/2	0.0	60

Borehole Notes:

Zero reference is the ground surface. The Fluor Field Team Leader was source of the casing data. This push hole is located approximately 60 ft south of the crib.

Logging Equipment Information:

Logging System:	Gamma 2A		**Type:** SGLS (35%) 34TP20893A
Calibration Date:	03/2004	**Calibration Reference:**	DOE-EM/GJ642-2004
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 2F		**Type** NMLS (H380932510)
Calibration Date:	09/03	**Calibration Reference:**	GJO-2003-520-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	**1**	**2 / Repeat**	**3 / Repeat**		
Date	05/13/04	05/13/04	05/27/04		
Logging Engineer	Pearson	Pearson	Pearson		
Start Depth (ft)	59.56	52.0	55.0		
Finish Depth (ft)	0.0	46.0	45.0		
Count Time (sec)	200	200	400		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A[3]	N/A	N/A		

Log Run	1	2 / Repeat	3 / Repeat		
Pre-Verification	BA332CAB	BA332CAB	BA341CAB		
Start File	BA334000	BA334061	BA341000		
Finish File	BA334060	BA334067	BA341010		
Post-Verification	BA334CAA	BA334CAA	BA342CAA		
Depth Return Error (in.)	0.0	0.0	0.0		
Comments	Adjusted gain after BA334050.	No gain adjustments.	No gain adjustments.		

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2 / Repeat		
Date	5/14/04	5/14/04		
Logging Engineer	Pearson	Pearson		
Start Depth (ft)	0.0	37.0		
Finish Depth (ft)	59.5	43.0		
Count Time (sec)	N/A	N/A		
Live/Real	N/A	N/A		
Shield (Y/N)	N/A	N/A		
MSA Interval (ft)	0.25	0.25		
ft/min	1.0	1.0		
Pre-Verification	BF176CAB	BF176CAB		
Start File	BF176000	BF176239		
Finish File	BF176238	BF176263		
Post-Verification	BF176CAA	BF176CAA		
Depth Return Error (ft)	N/A	0.0		
Comments	No gain adjustments.	No gain adjustments.		

Logging Operation Notes:

Zero reference was ground surface. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier. The first SGLS spectrum (BA334000) was collected at the bottom of the borehole. The tool reached total depth at 59.56 ft. The second SGLS repeat, on 5/27/04, used a counting time of 400 sec real time to investigate a possible zone of $^{235/238}$U.

Analysis Notes:

Analyst:	Sobczyk	**Date:**	6/07/04	**Reference:**	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectrum, as compared to the pre-run verification spectrum for the day were between 7.7 percent lower and 0.6 percent higher at the end of the day. The peak counts per second at 1461 keV showed the greatest variation of the KUT photopeaks on the post-run verification spectrum as compared to the pre-run verification spectrum. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Pre-run and post run verification spectra for the neutron tool were evaluated and were within the acceptance criteria.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. The post-run verification spectrum was used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2AMar04.xls). Zero reference was the ground surface. The casing configuration was assumed as one string of 6-in. casing with a thickness of 1/2 in. to 59.56 ft (total logging depth). Dead time corrections were applied at 48 and 49 ft where dead time exceeded 10.5 %. A water correction was not required.

NMLS log spectra were processed in batch mode using APTEC SUPERVISOR to determine count rates. Zero reference was the ground surface. Moisture calibration models at Hanford for 6-in.-diameter casing with 0.28-in. thickness have been established. A casing thickness correction (relative to 6-in. casing) can be estimated. Thus, corrections were applied to the gross neutron counts per second to estimate volumetric moisture content with the 6-in. hole-size correction and the ½-in. casing thickness for 6-in.-diameter casing.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, gross gamma and volume fraction of water, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs with 200 sec and 400 sec counting times versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected in the interval from 46 to 57 ft at concentrations ranging from 0.5 pCi/g to 600 pCi/g. The maximum concentration of ^{137}Cs was measured at 49 ft. ^{137}Cs was also detected at the ground surface (0 ft) with a concentration of 0.3 pCi/g.

Processed uranium was not detected in this borehole. During logging runs 1 and 2, data were acquired using a 200 sec count time at 1-ft intervals over the entire length of the borehole. During log run 3, data were acquired using a 400 sec count time at 1-ft intervals in a zone of expected ^{238}U contamination. The MDL for ^{238}U was approximately 18 pCi/g during logging runs 1 and 2 and approximately 14 pCi/g during log run 3.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV and ^{137}Cs at 662 keV. The rerun of the neutron-moisture tool showed good repeatability.

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[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

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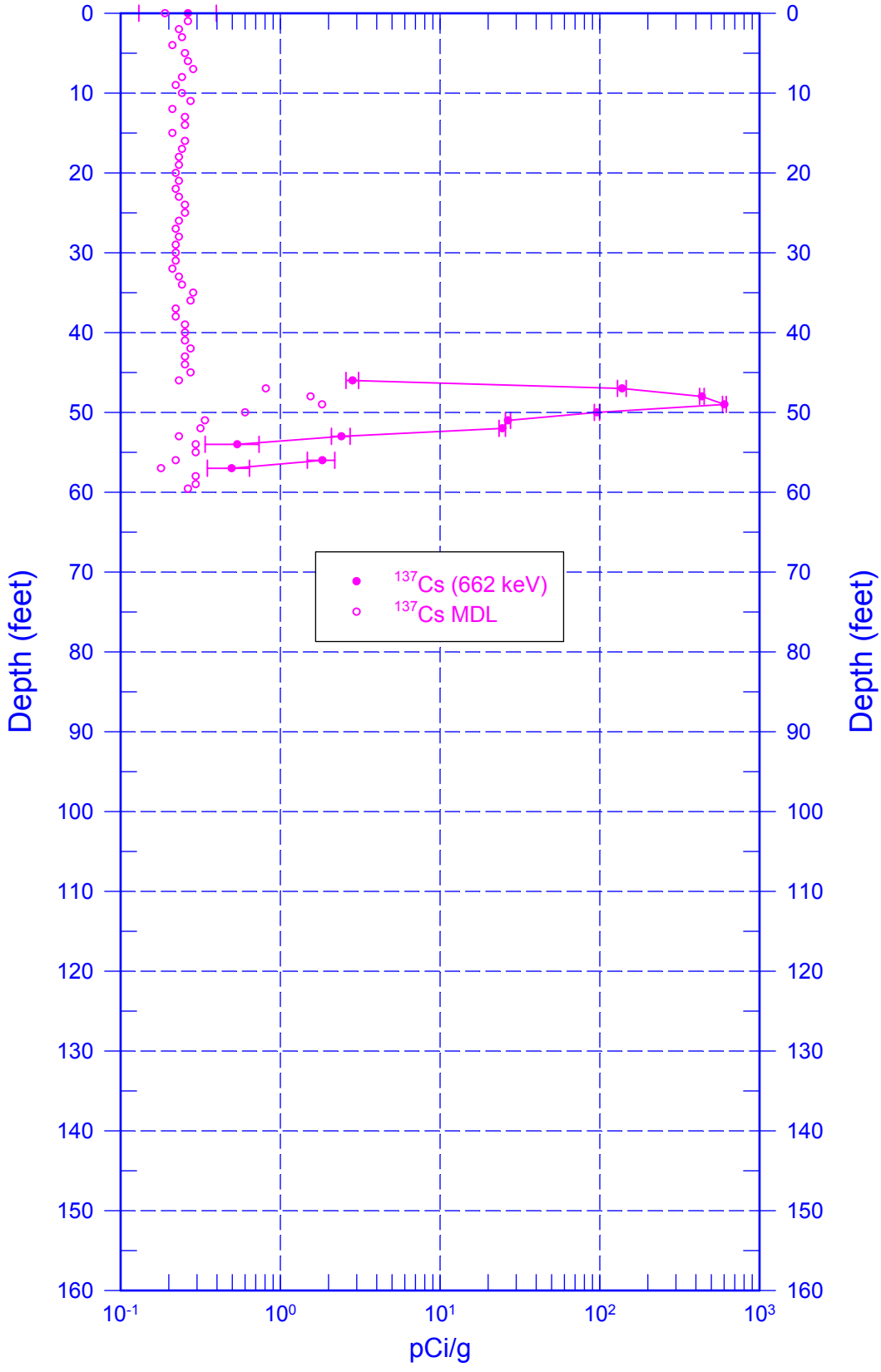
Man-Made Radionuclides



Zero Reference = Ground Surface

Date of Last Logging Run
5/13/2004

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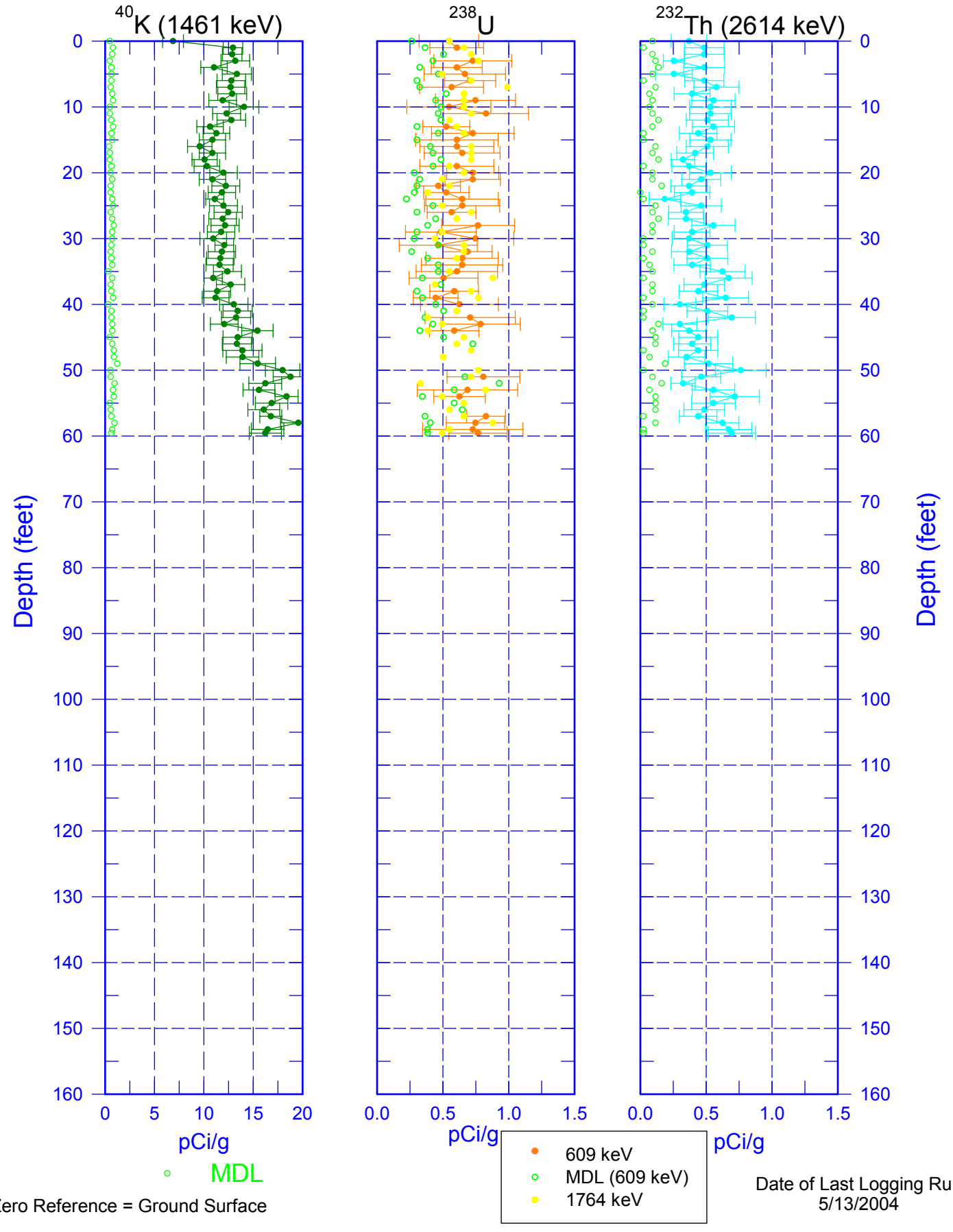
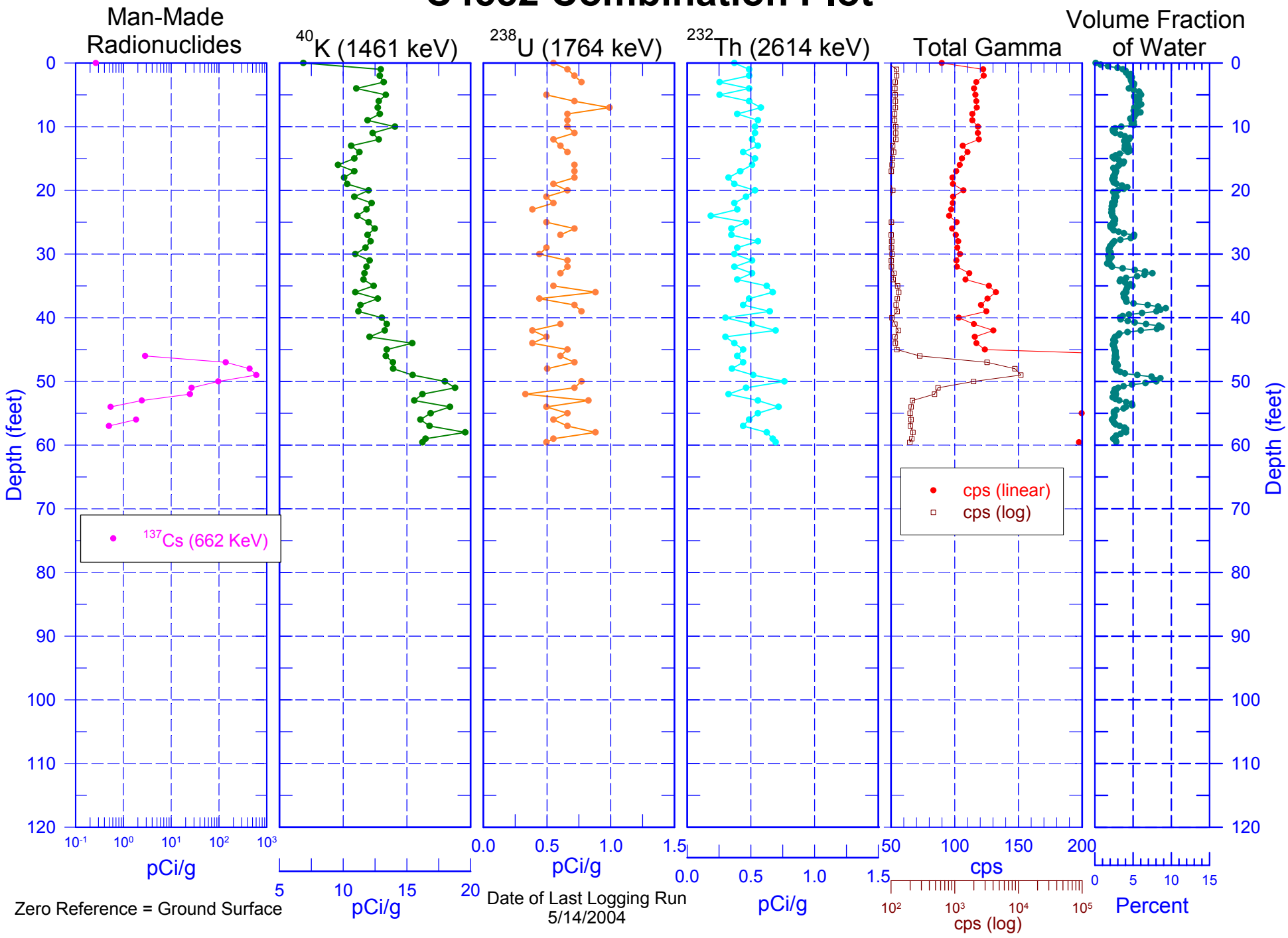
Natural Gamma Logs

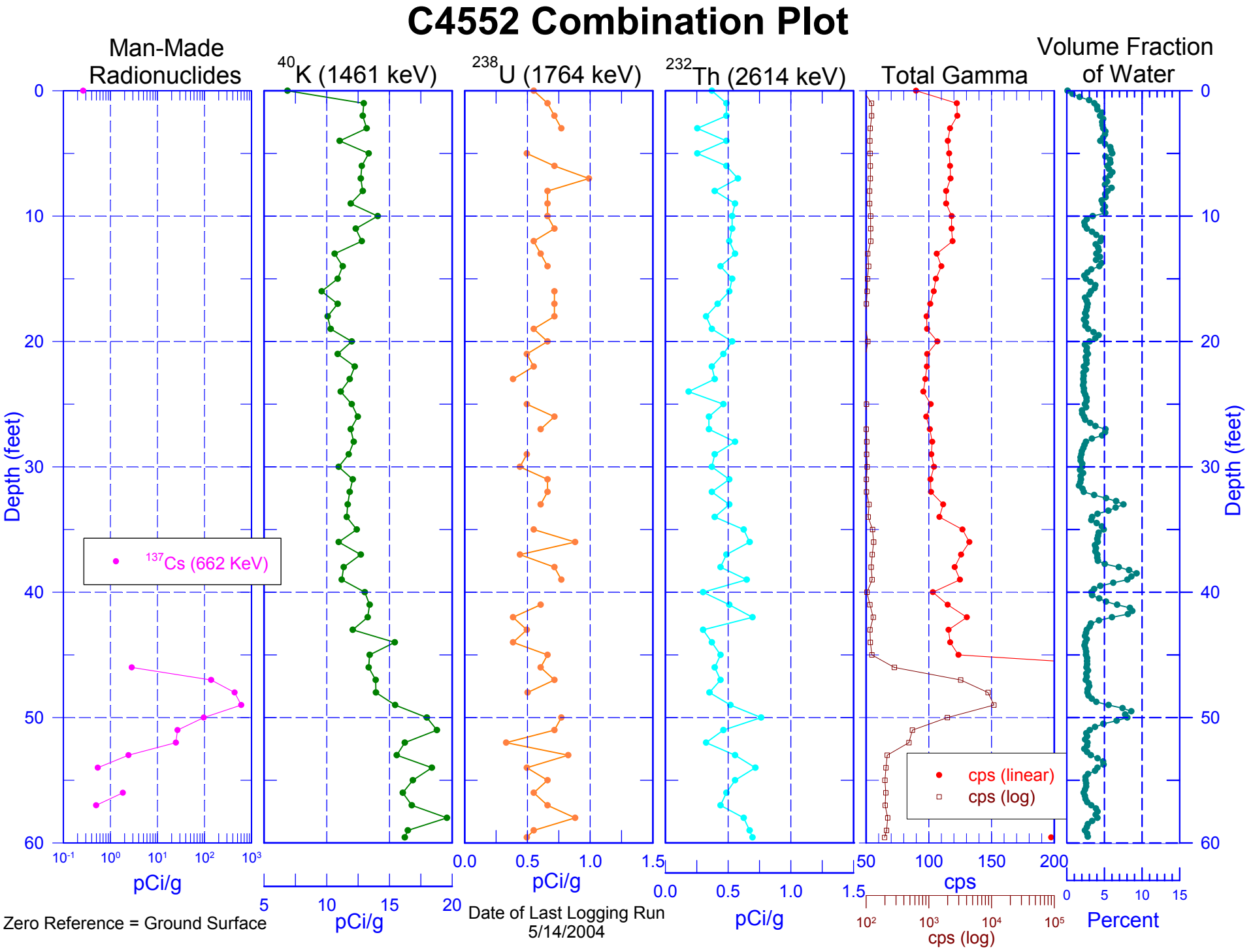


Zero Reference = Ground Surface

Date of Last Logging Run
5/13/2004

C4552 Combination Plot




C4552 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Volume Fraction of Water
Depth (feet)
137Cs (662 KeV)
pCi/g
cps (linear)
cps (log)
cps
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
5/14/2004

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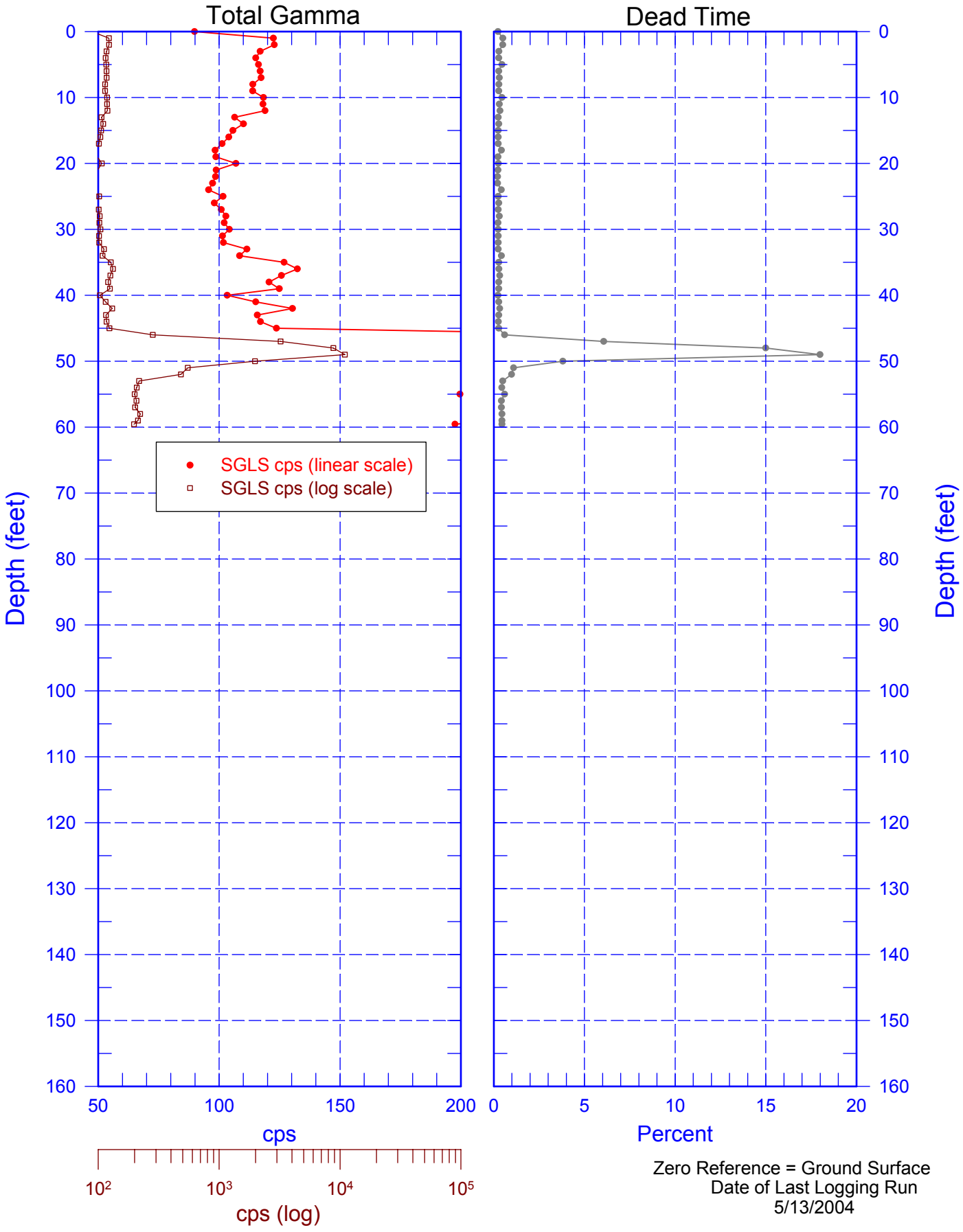
Total Gamma & Dead Time



Zero Reference = Ground Surface
Date of Last Logging Run
5/13/2004

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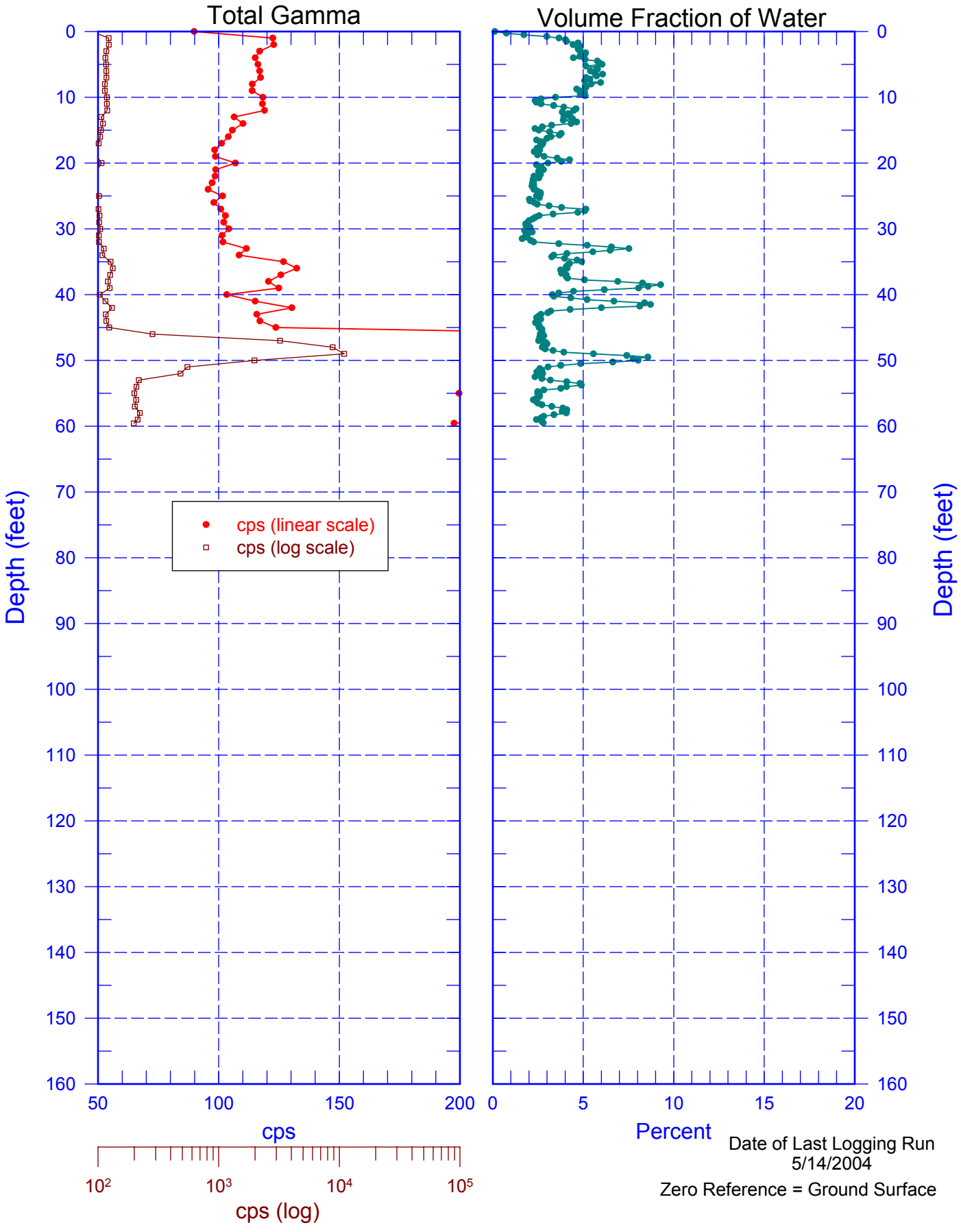
Total Gamma & Neutron



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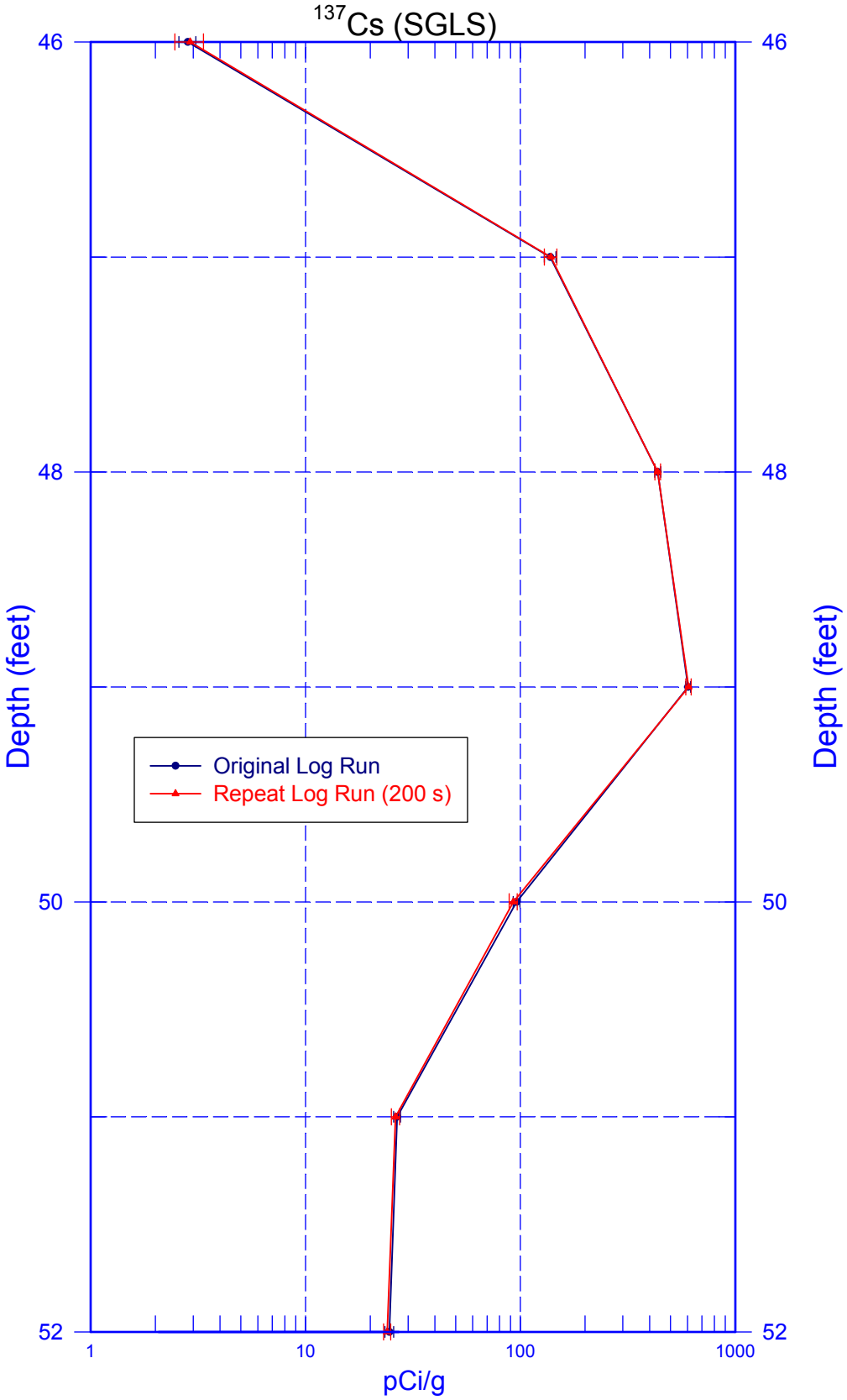
Rerun of Man-Made Radionuclides



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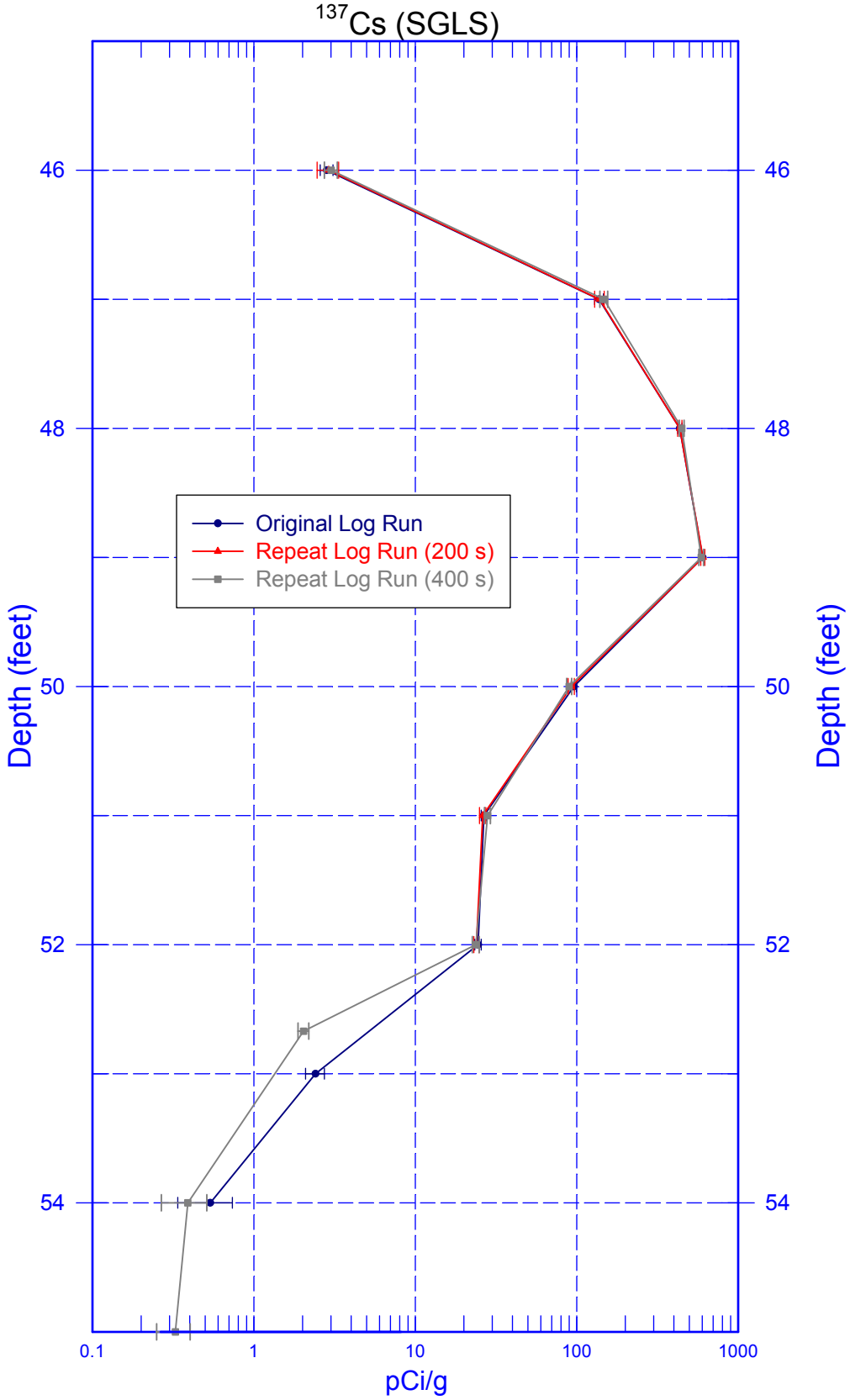
Rerun of Man-Made Radionuclides (45.0 to 55.0 ft)



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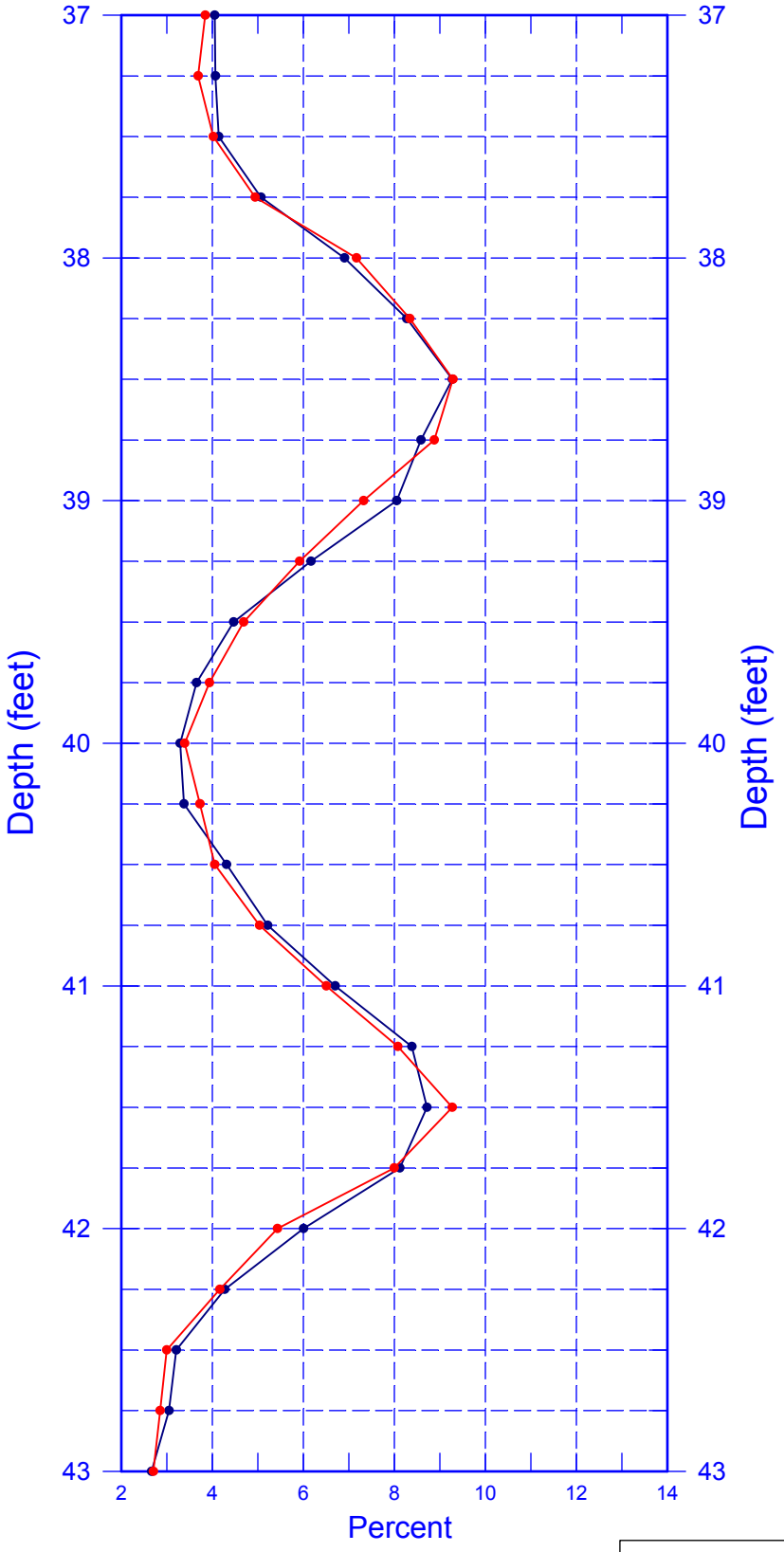
Volume Fraction of Water Rerun



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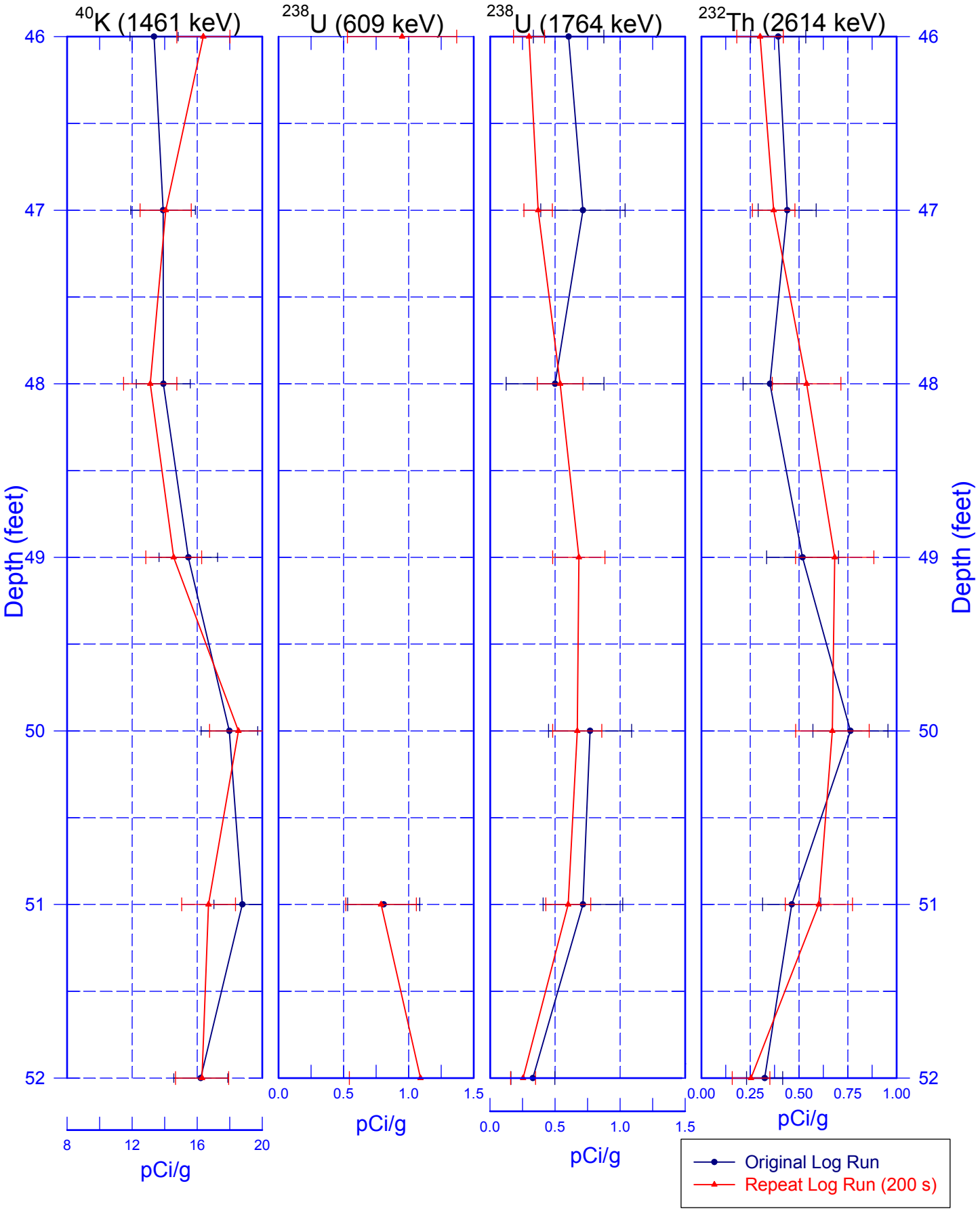
Rerun of Natural Gamma Logs (52.0 to 46.0 ft)



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Rerun of Natural Gamma Logs (55.0 to 45.0 ft)